Introduction of this course

李宏毅

Hung-yi Lee

Policy

評量方式

- 不點名、不考試
- 作業 (60%)：沒有分組、每個人都要繳交
- 期末專題 (40%)：分組進行

成績是相對的

成績是相對的

成績是相對的

評量方式 - 作業 (60%)

- 作業一 (10%)：3/02 – 3/23 (三週)
- 作業二 (10%)：3/23 – 4/06 (二週)
- 作業三 (10%)：4/06 – 5/04 (四週)
- 作業四 (10%)：4/27 – 5/11 (二週)
- 作業五 (10%)：5/11 – 5/25 (二週)
- 作業六 (10%)：5/25 – 6/08 (二週)

評量方式 - 作業 (60%)

- 程式碼：程式碼要符合指定格式可以順利執行，經助教要求修改後才能執行會被扣分
- 課堂內競賽成績：同學上傳程式執行結果到競賽專用平台 Kaggle，可以即時得知成果
  - 達到 baseline 就得到大部分的分數
  - 課堂內競賽成績優異的同學會被邀請在課堂上發表，會有額外的加分。
  - 課堂內競賽視同考試，嚴禁任何作弊行為
    - 在機器學習過程中使用禁止使用的資料，如測試資料(視同考試攜帶小抄)
    - 註冊多重分身參加比賽(視同考試請人代考)
- 繳交報告回答問題

評量方式 - 期末專題

- 期末專題 (40%)：
  - 2 ~ 4人一組
  - 找不到隊友也沒關係，會幫忙配對
- 5/04 公告題目
- 進行方式：會公告幾個可能的題目給同學們選擇，其餘規定同作業
- 最後會有組內互評

上課

- 老師上課時間：週四上午 9:10 – 12:10
  - 上課投影片和錄音會放到李宏毅的個人網頁上
  - 李宏毅的個人網頁：http://speech.ee.ntu.edu.tw/~tlkagk/courses_ML17.html
- 助教時間：
  - **在作業截止的前一週**週四中午 12:20 – 1:10，由助教示範、講解作業實作方式
    - 不一定要參加
  - 在講解作業前就在 Kaggle 上達到 baseline 會有額外加分
- 3/09 老師請假

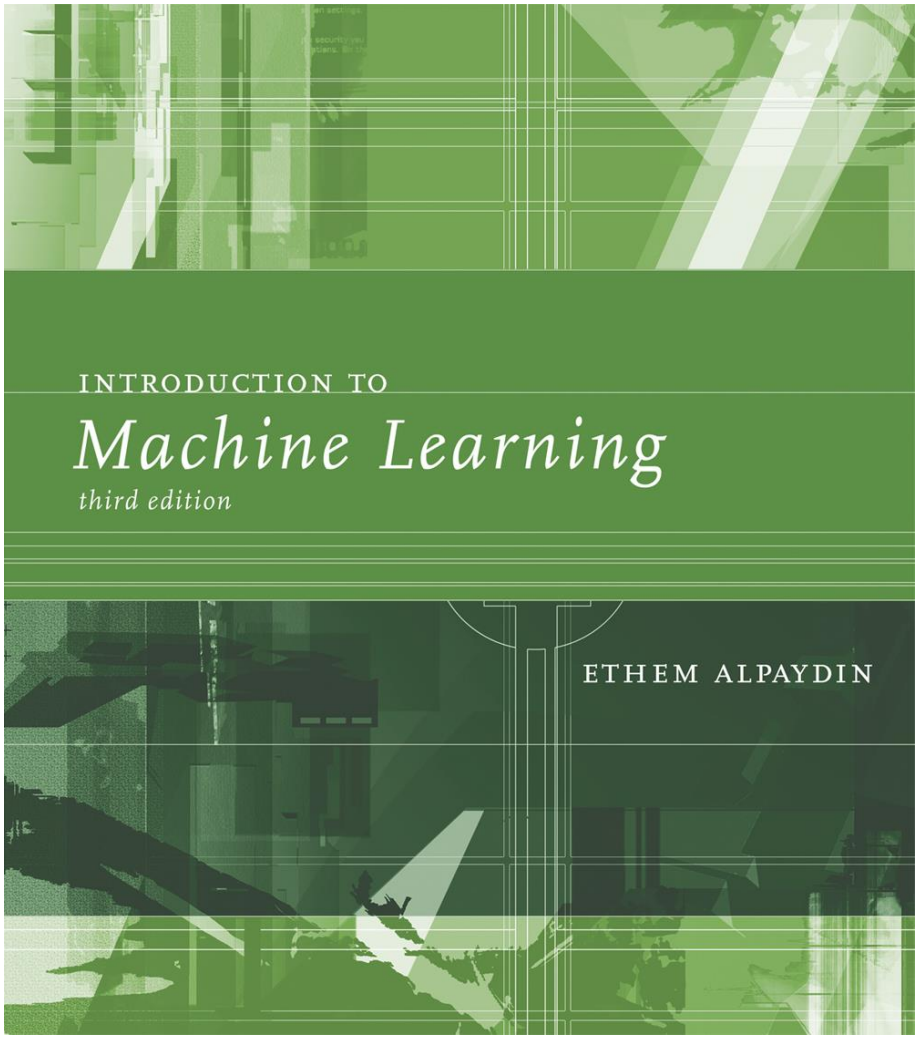
FB 社團

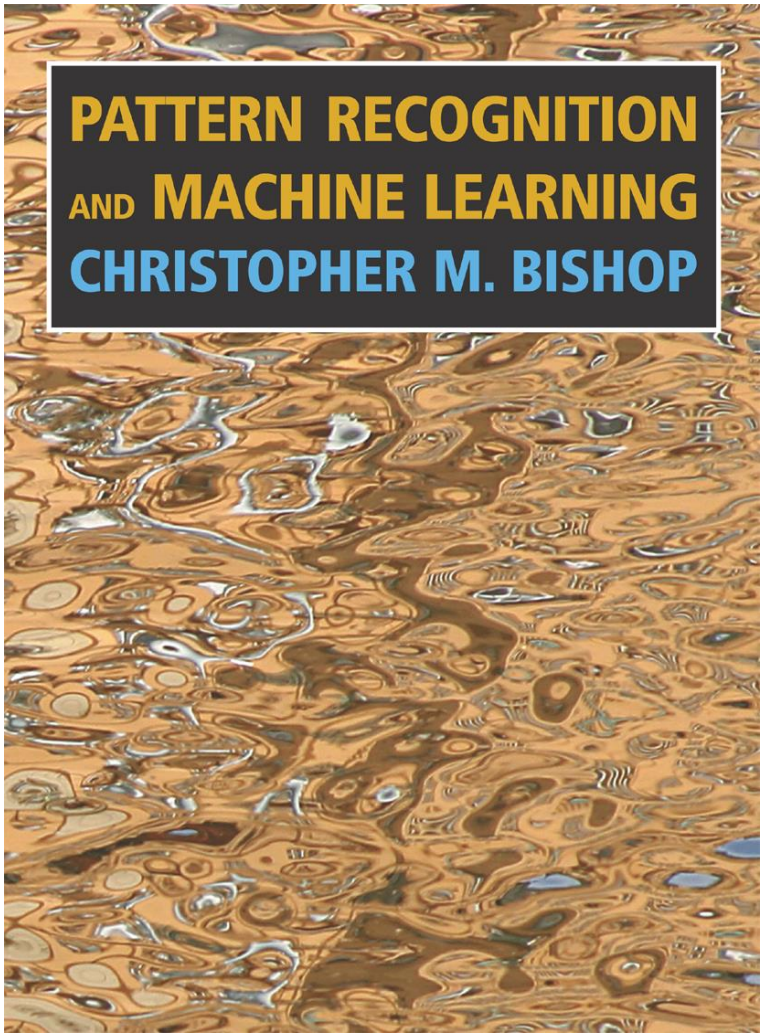
- 社團: “Machine Learning (2017, Spring)”
  - https://www.facebook.com/groups/226970244375624/
- 有問題可以直接在 FB社團上發問
  - 如果有同學知道答案請幫忙回答
- 有想法也可以在 FB社團上發言
- 會紀錄好的問題、答案、留言，期末會加分

加簽

- 如果上學期「正確」完成作業零但沒有加簽，等一下直接加簽
- 助教會公告作業 0 ，明天 (週五) 12:00 前完成
  - 作業 0 跟機器學習無關，只是測驗基礎程式能力
  - 完成作業 0 就加簽，助教會公告授權碼取得方式

參考書籍


INTRODUCTION TO
Machine Learning
third edition
ETHEM ALPAYDIN


PATTERN RECOGNITION
AND MACHINE LEARNING
CHRISTOPHER M. BISHOP

FAQ

- Q: 和上學期的 “Machine Learning” (ML) 有何不同？
- A: 基本上是一樣的，只是增加作業量和助教時間。
  - 如果上學期你有拿到 ML 的學分，禁止再修一次
- Q: 和這學期週五下午的 “Machine Learning and having it Deep and Structured” (MLDS) 有何不同？
- A: ML 和 MLDS 內容完全不同
  - MLDS 會著重於 deep learning 和 structured learning ，且和 ML 不重複

Welcome our TAs

TA 信箱：ntu.mlta@gmail.com

作業零

許宗媛

李佳軒

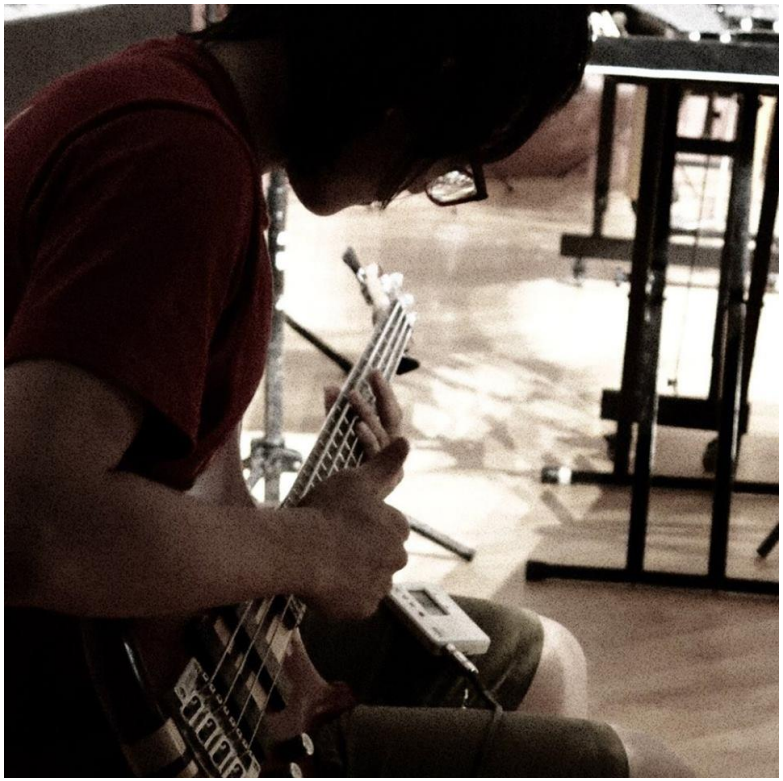
作業一

楊靖平

李佳軒

作業二

葉政杰



蔡哲平

作業三

徐瑞陽

陳奕禎

作業四

方為

茅耀文

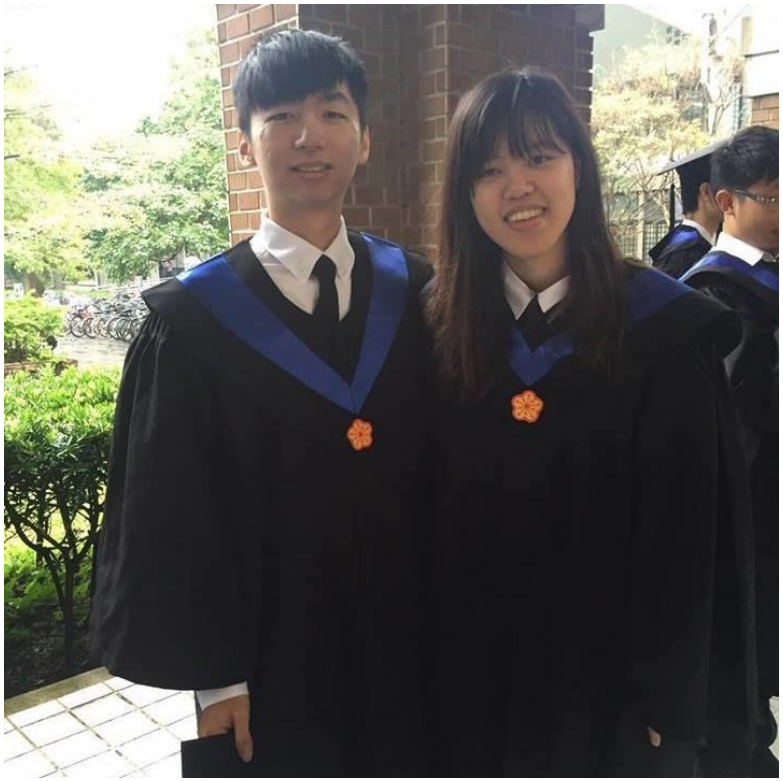
作業五

周儒杰

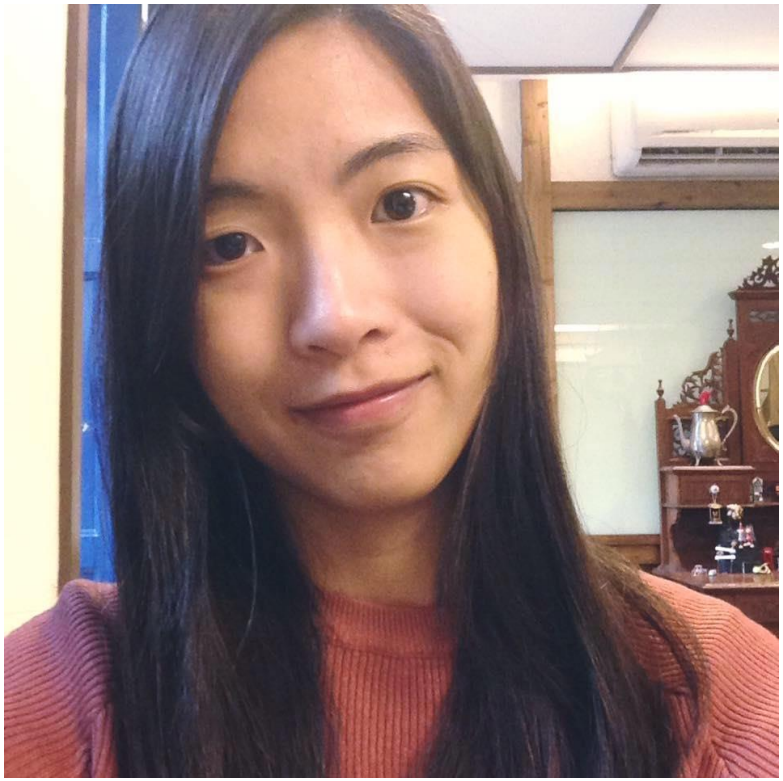
王耀賢

作業六

王上銘



宋昀蓁



大助教
－盧柏儒

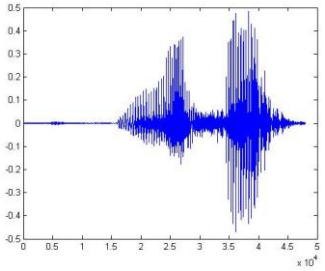
臉書社團管理

24

陳冠宇

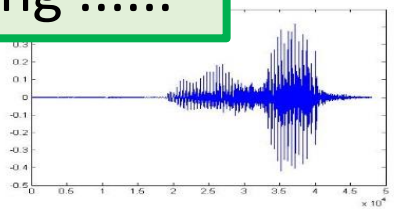
What is Machine Learning?

What is Machine Learning?

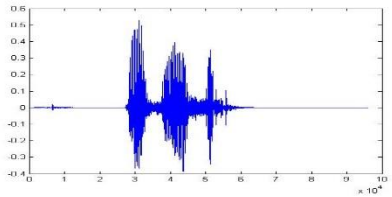


You said “Hello”

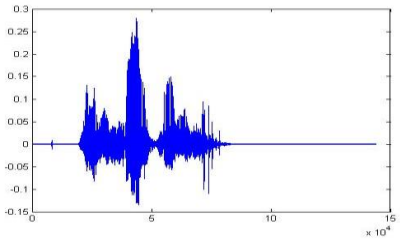
Learning ……



“Hi”



“How are you”



“Good bye”

A large amount of audio data

You write the program for learning.

What is Machine Learning?

Learning .....

This is “cat”

You write the program for learning.

“monkey”

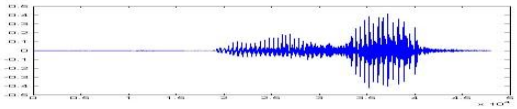
“cat”

“dog”

A large amount of images

Machine Learning ≈ Looking for a Function

- Speech Recognition

$f($  $)=$ “How are you”

- Image Recognition

$f($  $)=$ “Cat”

- Playing Go

$f($  $)=$ “5-5” (next move)

- Dialogue System

$f($ “Hi” $)=$ “Hello”

(what the user said) (system response)

Framework

Image Recognition:

$f($  $)=$ “cat”

A set of function

Model

$f_1, f_2 \cdots$

$f_1($  $)=$ “cat”

$f_2($  $)=$ “money”

$f_1($  $)=$ “dog”

$f_2($  $)=$ “snake”

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of function

Model

$f_1, f_2 \cdots$

Goodness of function f

Training Data

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

Better!

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

function input:   

function output: "monkey" "cat" "dog"

Framework

Image Recognition:

$f($  $)=$ "cat"

Training

Testing

Step 1

A set of function

Model

$f_1, f_2 \cdots$

Step 2

Goodness of function f

Step 3

Pick the "Best" Function

f^*

Training Data

"monkey"

"cat"

"dog"

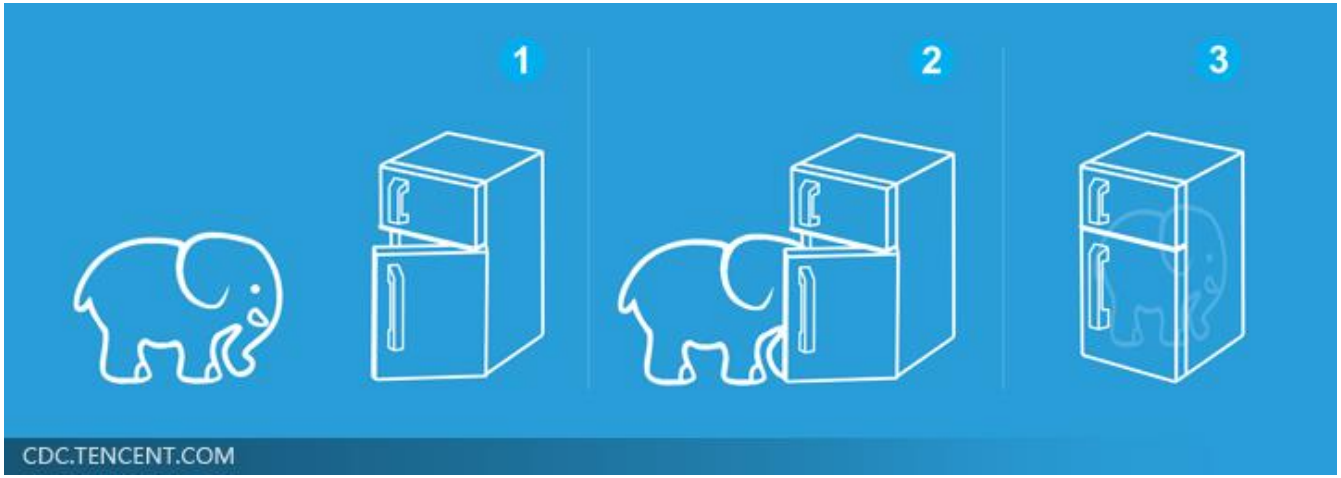
"cat"

Using f^*

Machine Learning is so simple ……

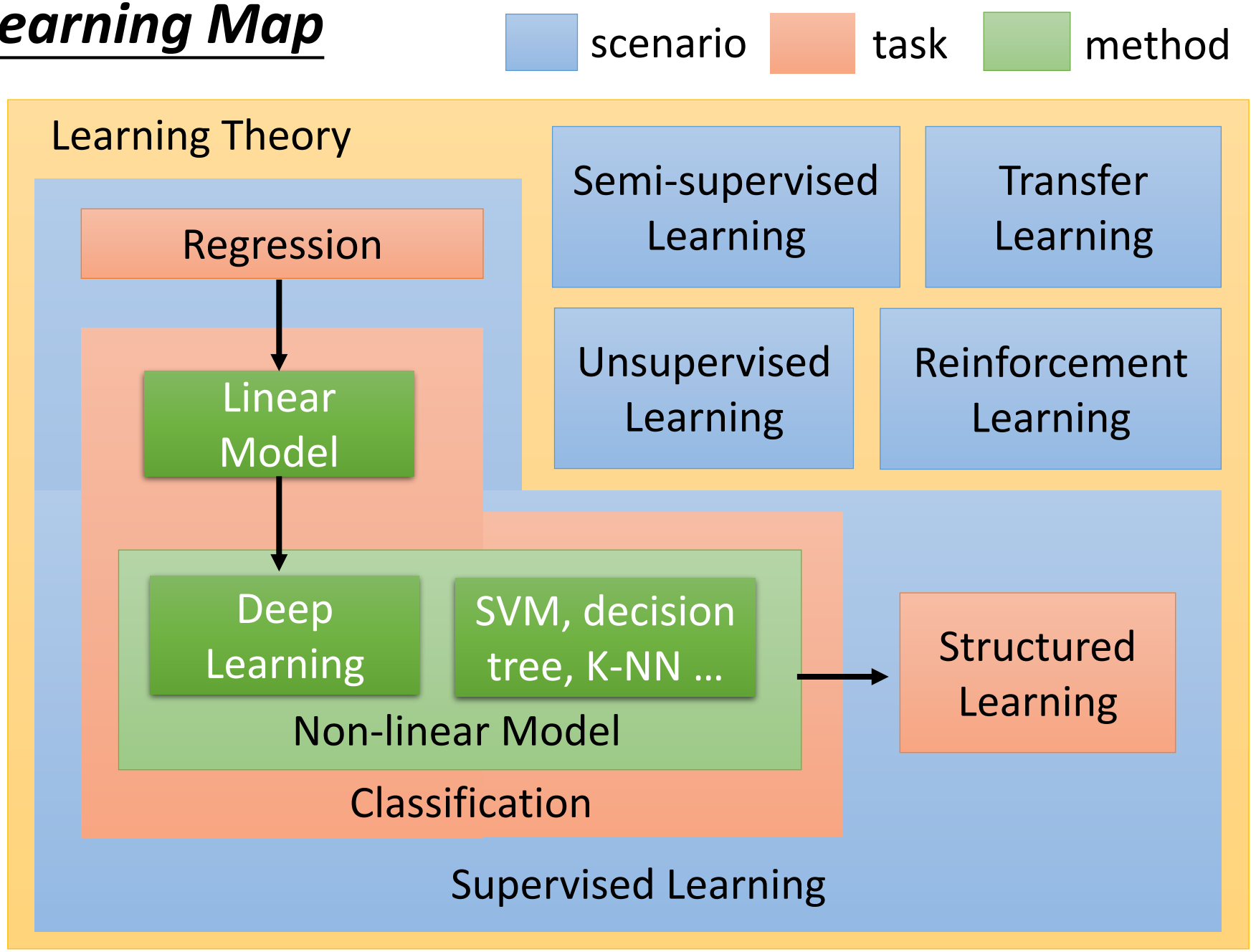
Step 1: define a set of function → Step 2: goodness of function → Step 3: pick the best function

就好像把大象放進冰箱 ……



Learning Map

Learning Map

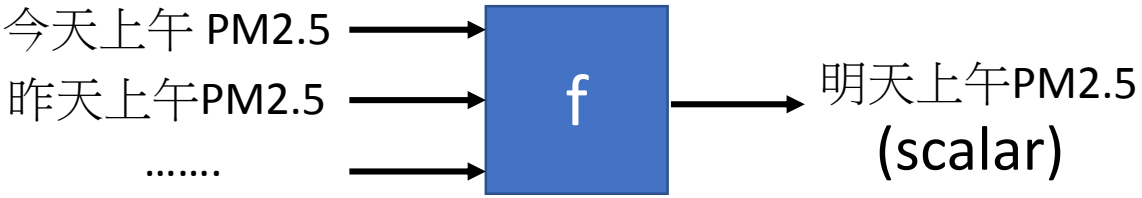


Learning Map

Regression

The output of the target function f is "scalar".

預測 PM2.5



Training Data:

Input:

9/01 上午 PM2.5 = 63　9/02 上午 PM2.5 = 65

Output:

9/03 上午 PM2.5 = 100

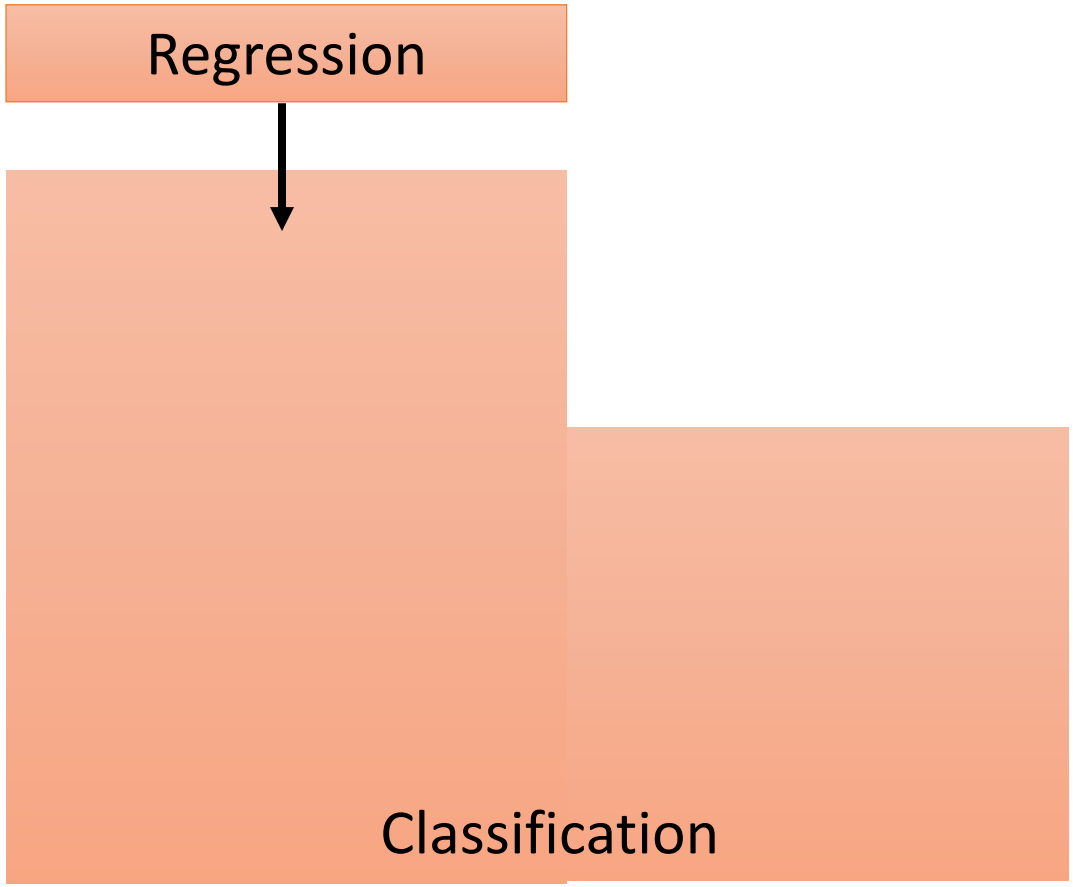
Input:

9/12 上午 PM2.5 = 30　9/13 上午 PM2.5 = 25

Output:

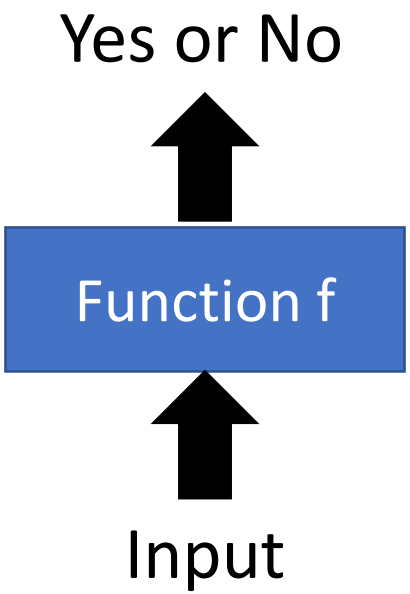
9/14 上午 PM2.5 = 20

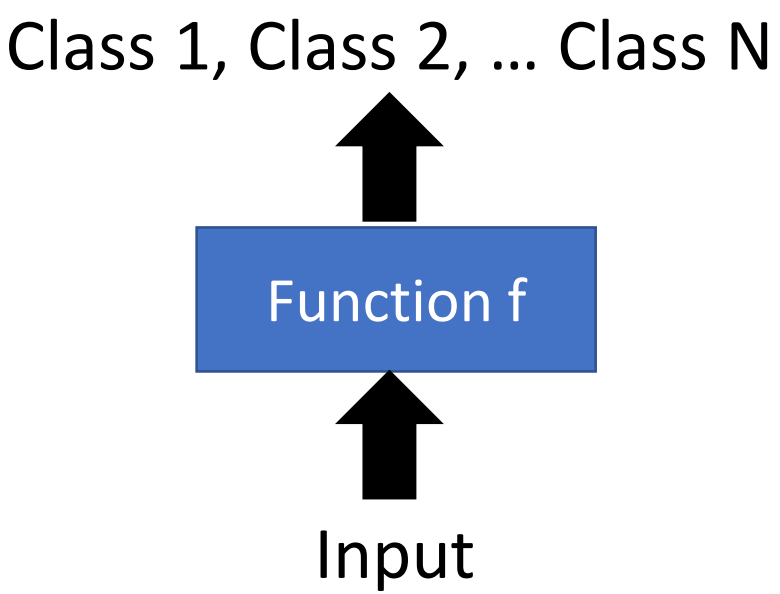
Learning Map



Classification

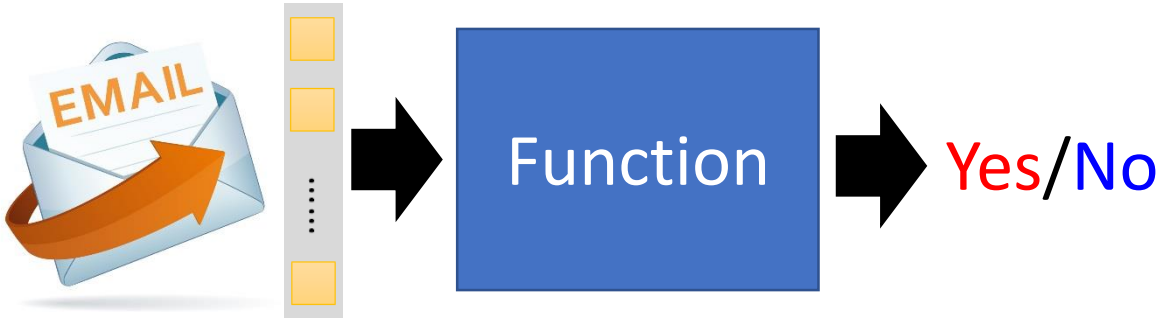
- Binary Classification
- Multi-class Classification





Binary Classification

Spam filtering



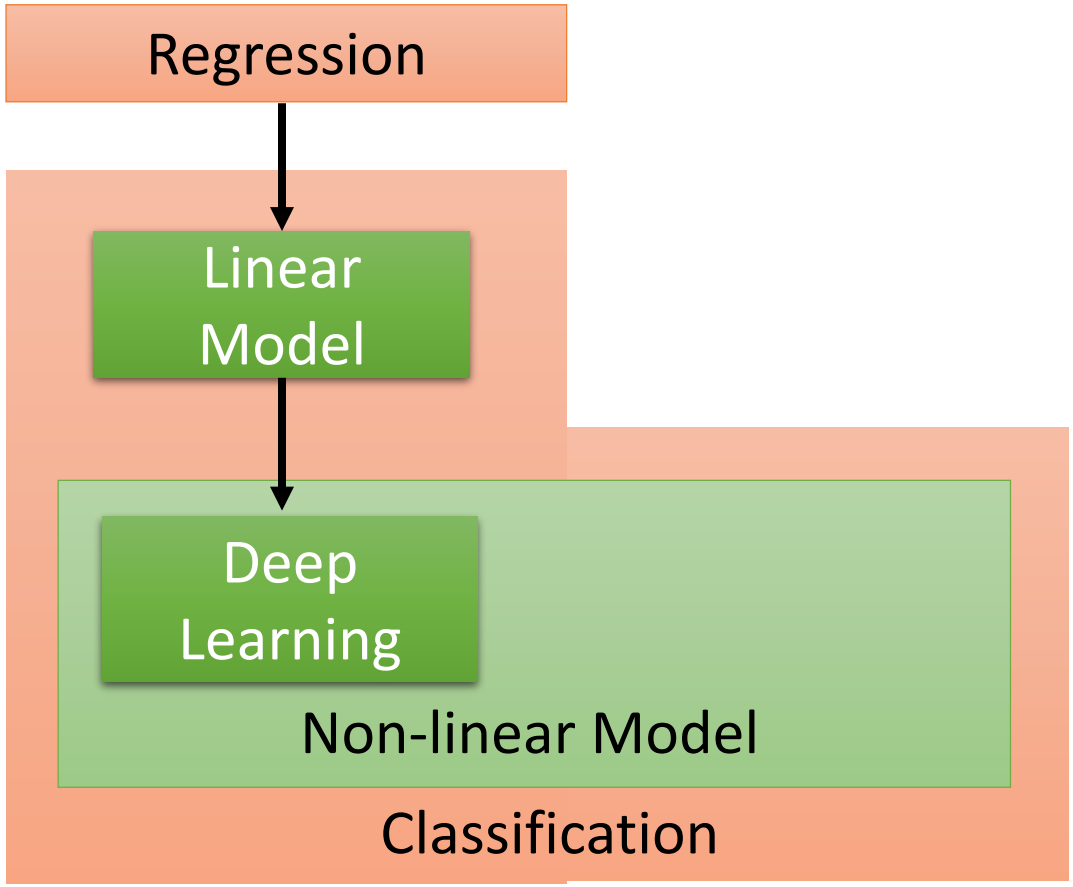
Training Data

(http://spam-filter-review.toptenreviews.com/)

Multi-class Classification

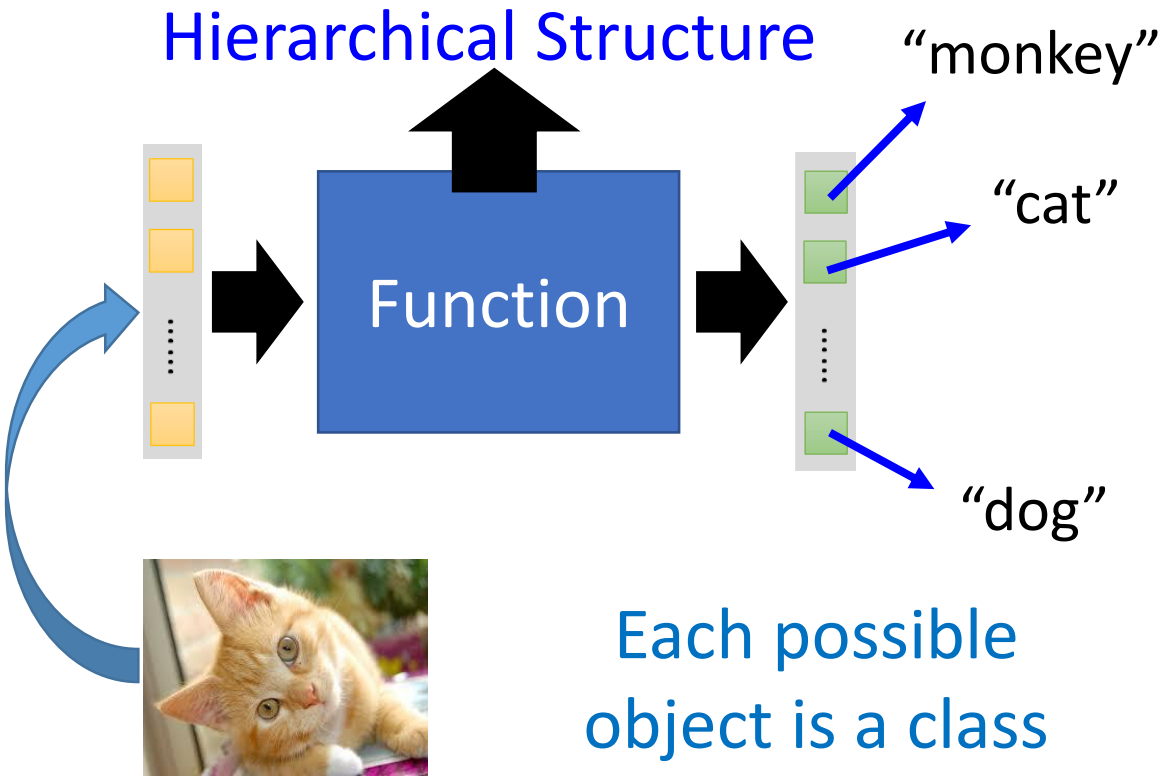
Document Classification

Learning Map



Classification - Deep Learning

- Image Recognition



Classification - Deep Learning

- Playing GO

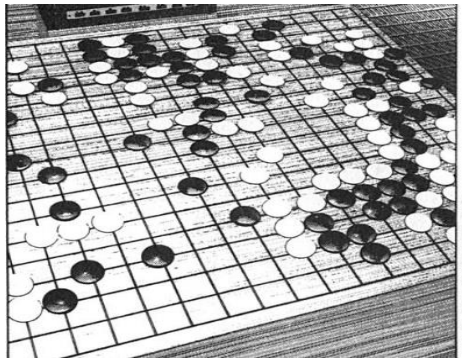
Function

Next move

Each position is a class

(19 x 19 classes)

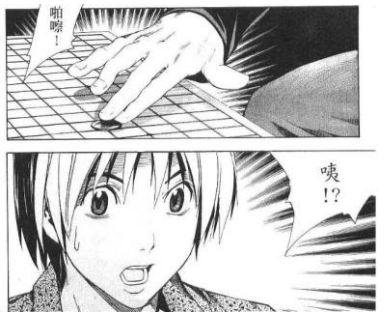
Training Data



一堆棋譜

進藤光 v.s. 社清春

黑: 5之五 ⟶ 白: 天元 ⟶ 黑: 五之5



Classification - Deep Learning

- Playing GO

Function

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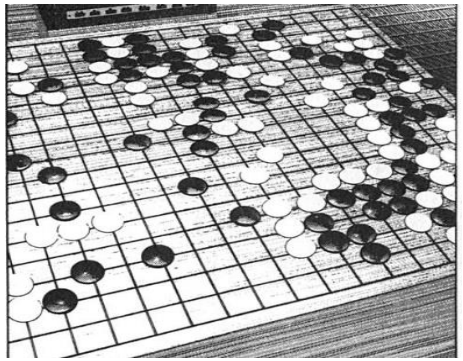
Training Data



一堆棋譜

進藤光 v.s. 社清春

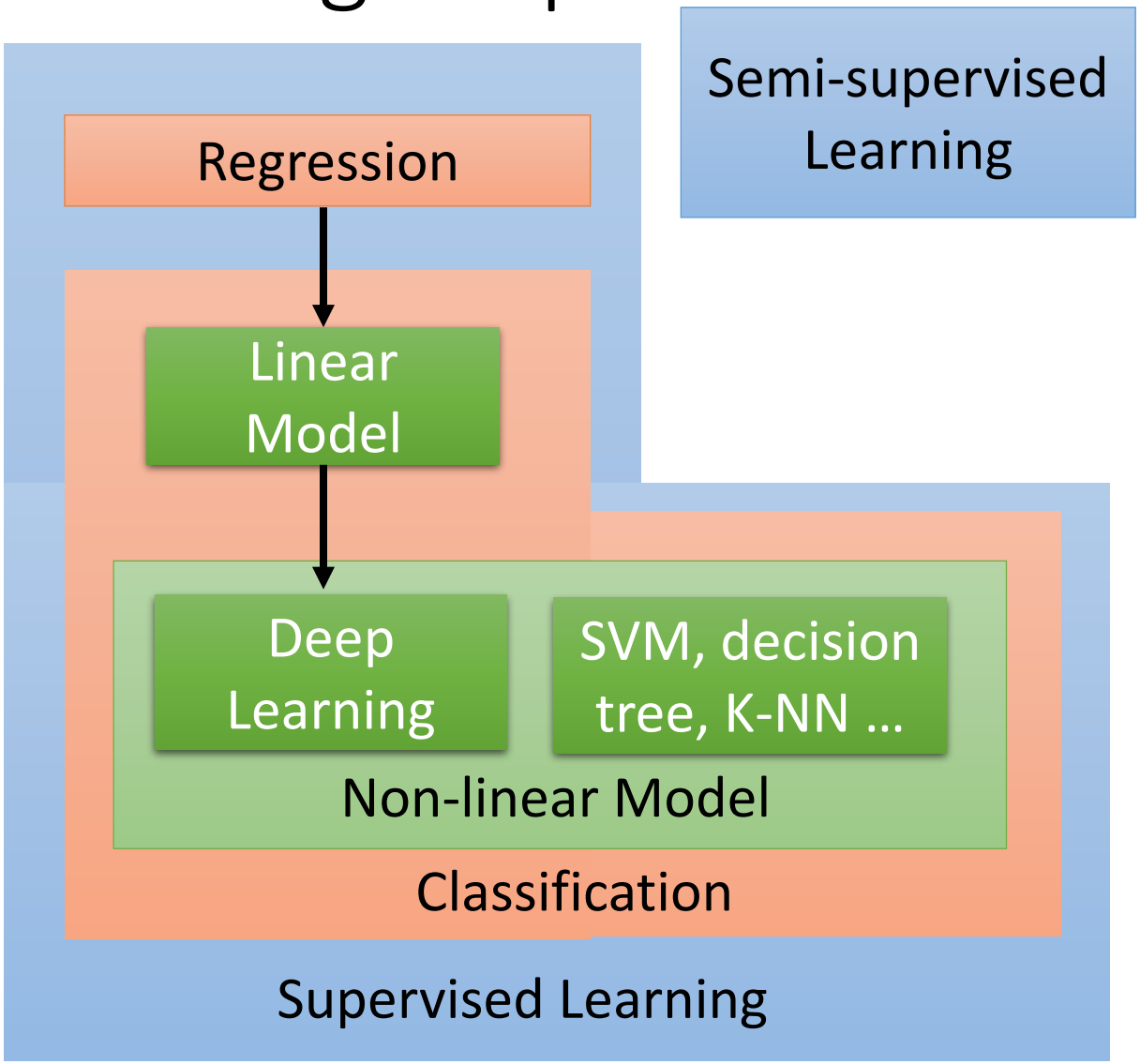
黑: 5之五 → 白: 天元 → 黑: 五之5

Input:
黑: 5之五 → Output:
天元

Input:
黑: 5之五、白: 天元 → Output:
五之5

Learning Map

Hard to collect a large amount of labelled data



Training Data:

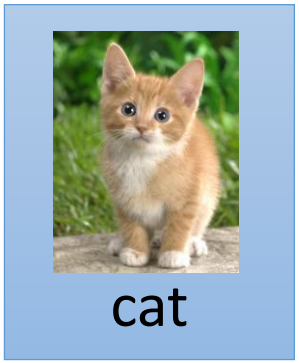
Input/output pair of target function

Function output = label

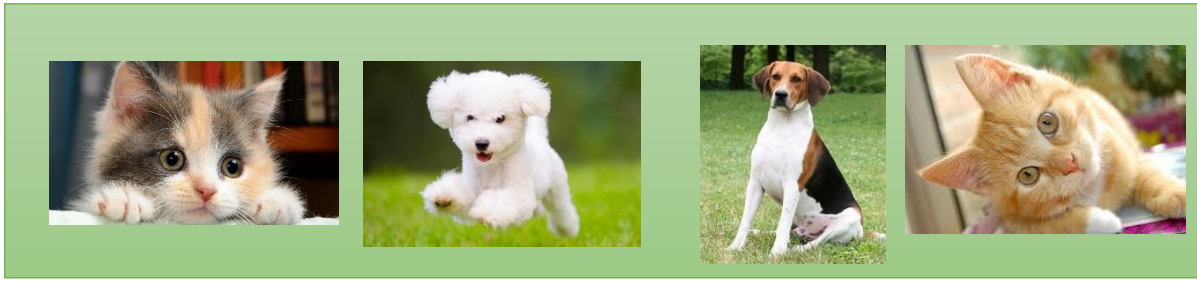
Semi-supervised Learning

For example, recognizing cats and dogs

Labelled data

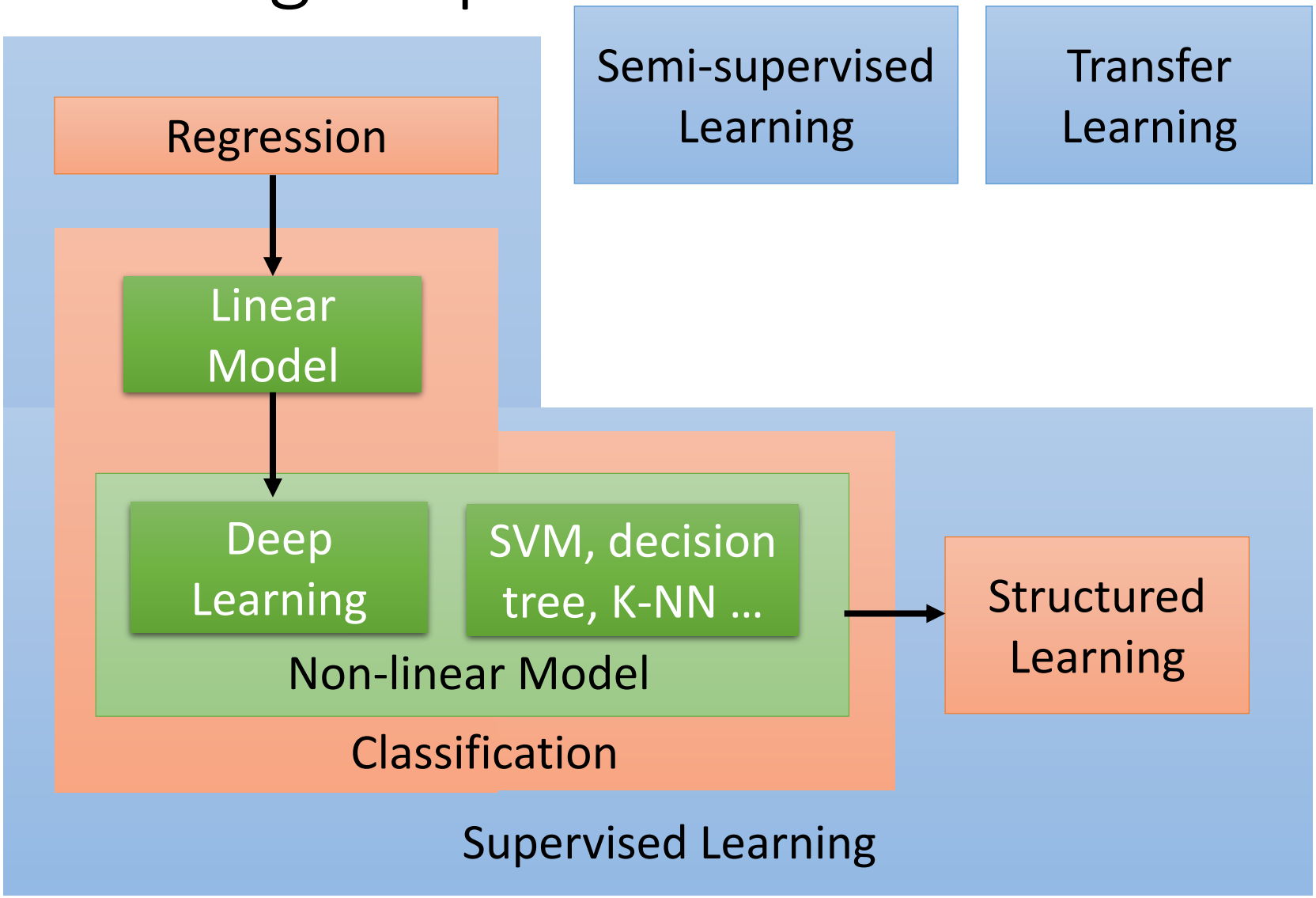


Unlabeled data



(Images of cats and dogs)

Learning Map



Transfer Learning

For example, recognizing cats and dogs

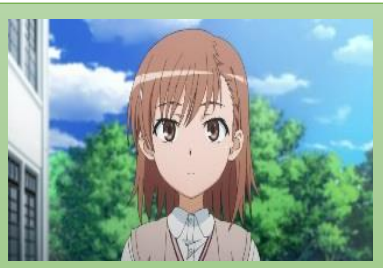
Labelled data

cat

dog

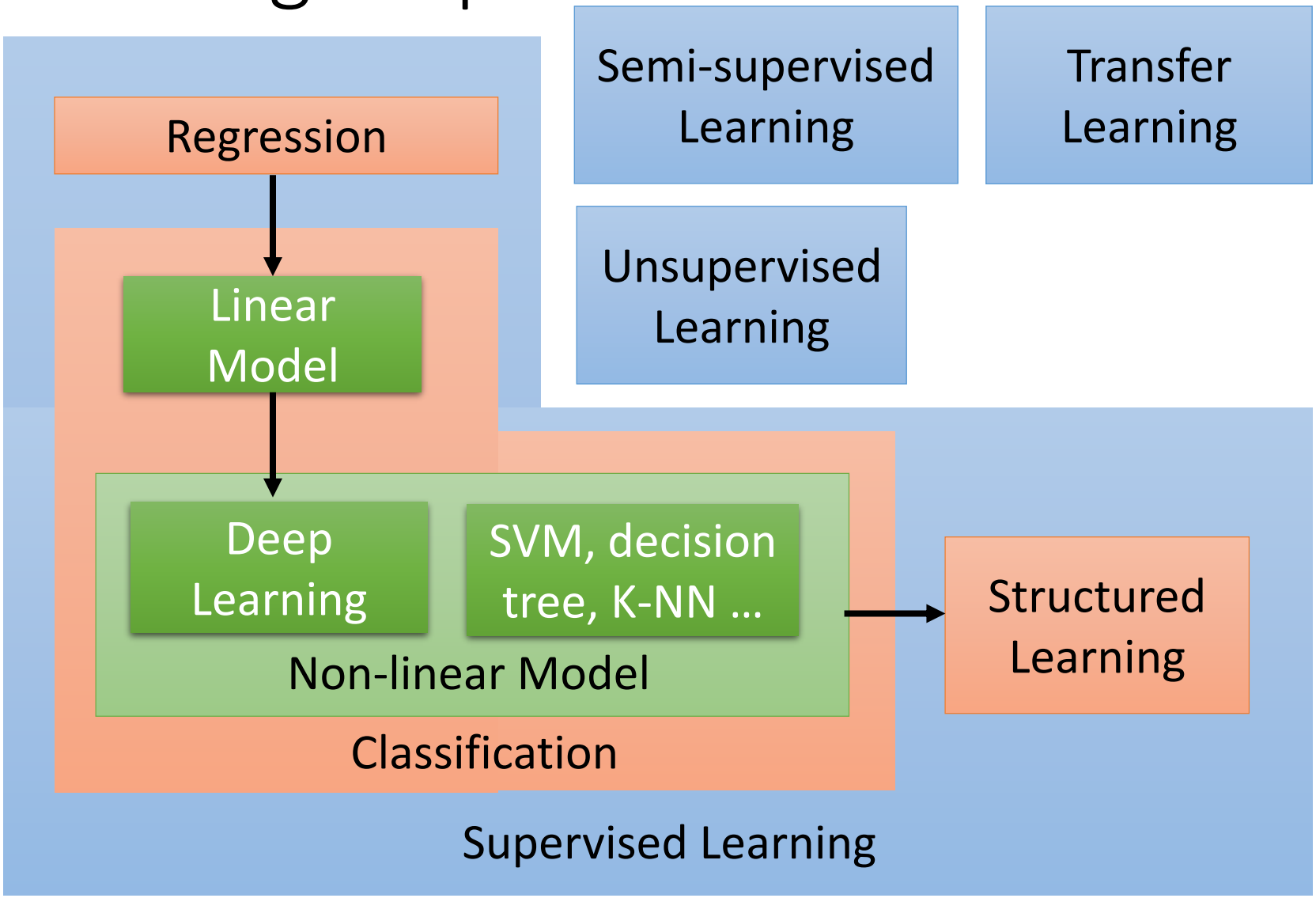
elephant

Haruhi



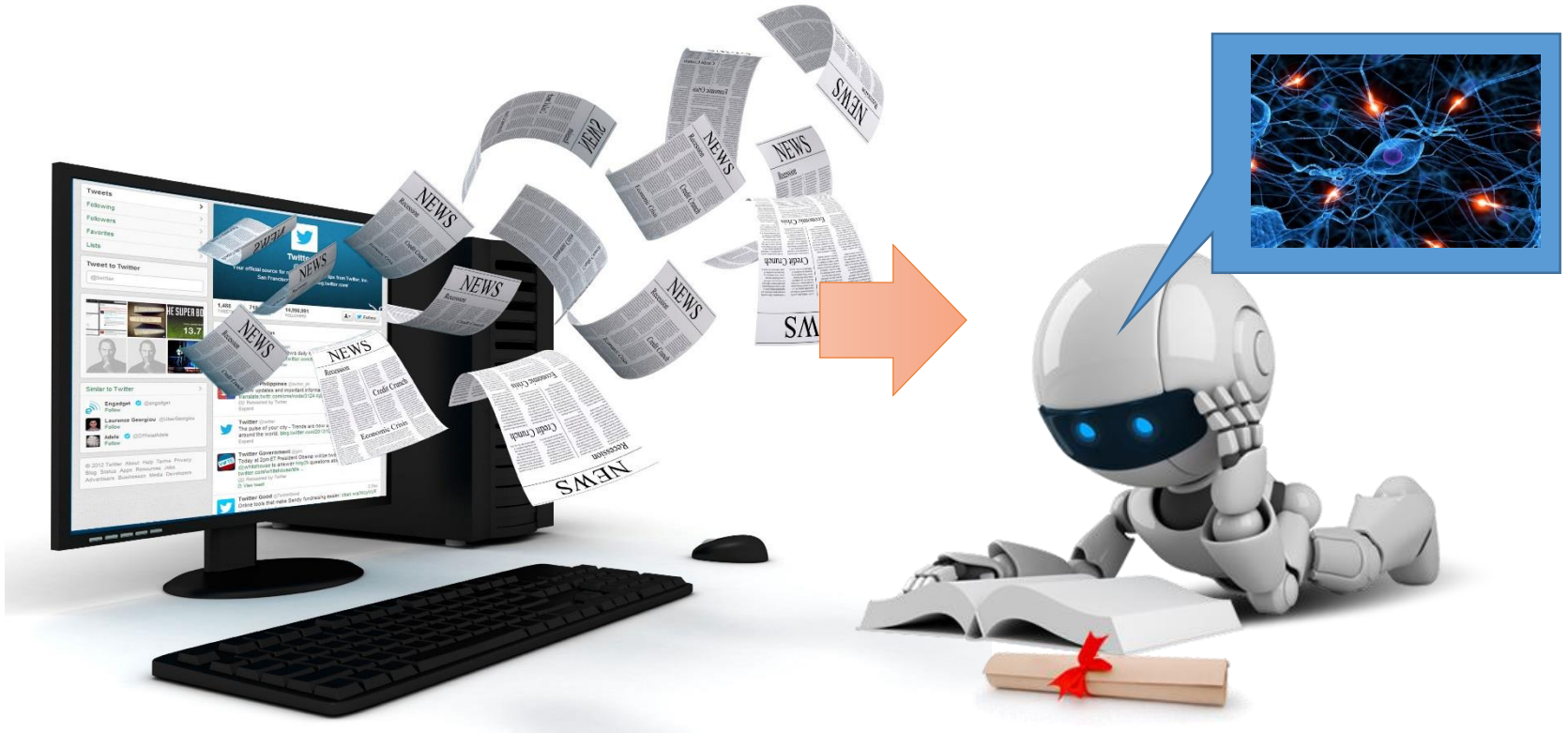
Data not related to the task considered
(can be either labeled or unlabeled)

Learning Map



Unsupervised Learning

- Machine Reading: Machine learns the meaning of words from reading a lot of documents



http://top-breaking-news.com/

Unsupervised Learning

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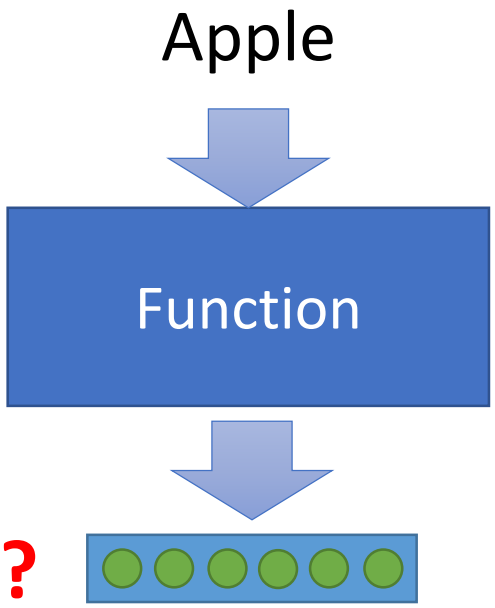


Training data is a lot of text

https://garavato.files.wordpress.com/2011/11/stacksdocuments.jpg?w=490

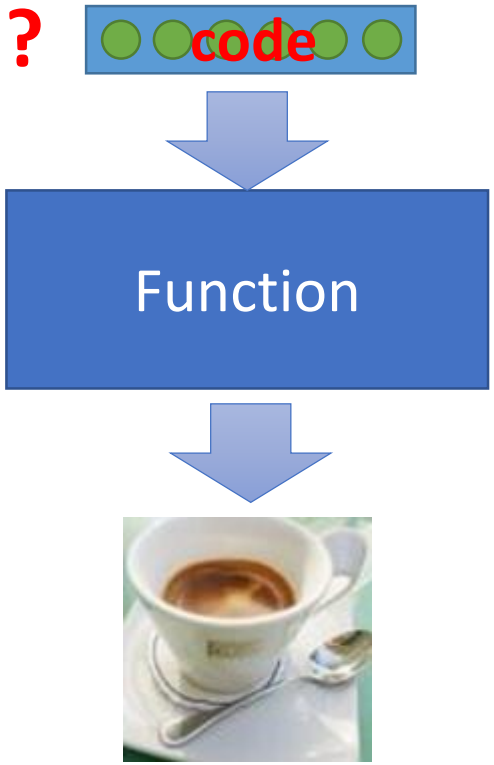
Unsupervised Learning

Draw something!

http://ttic.uchicago.edu/~klivescu/MLSLP2016/
(slides of Ian Goodfellow)

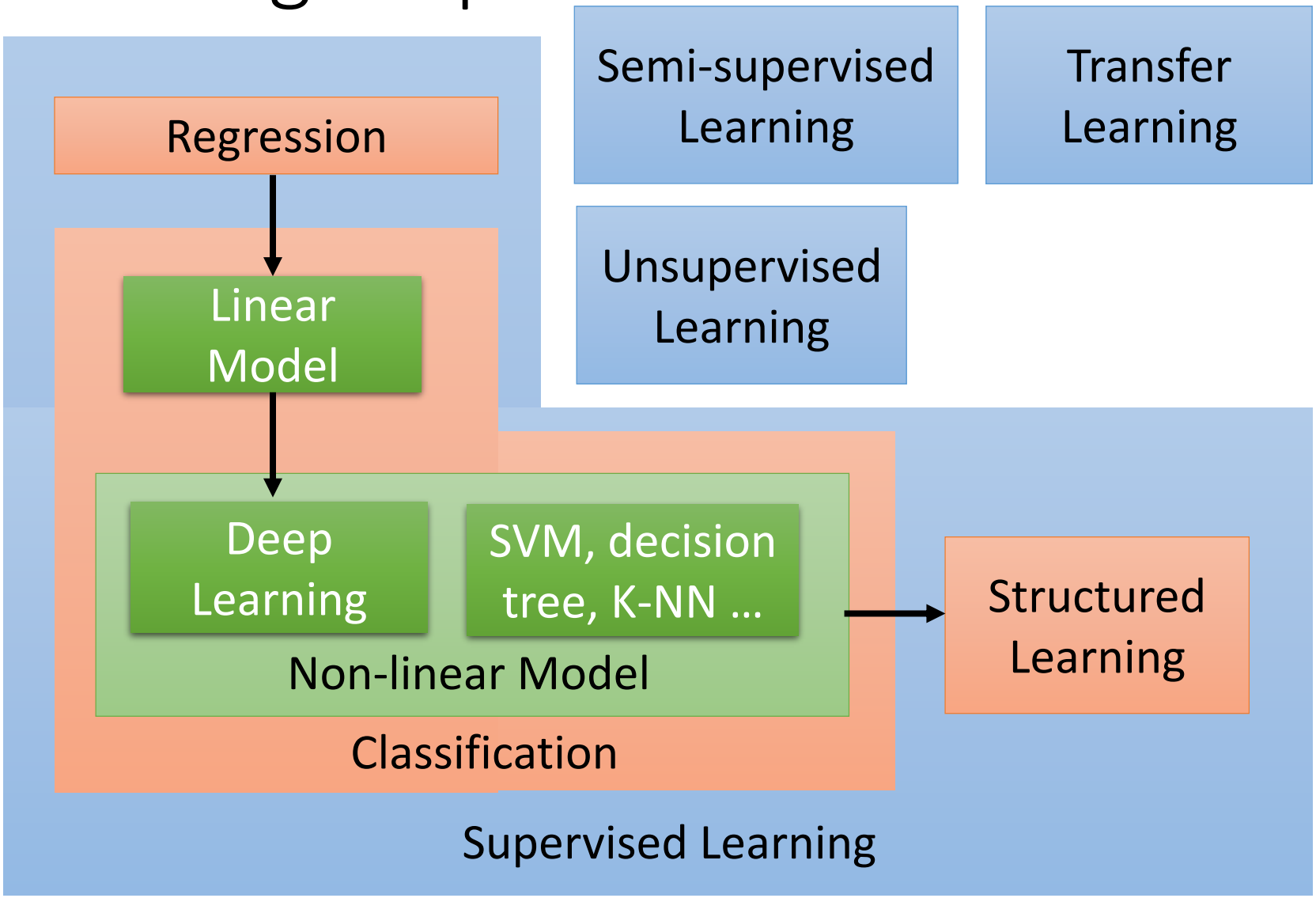
Unsupervised Learning

- Machine Drawing

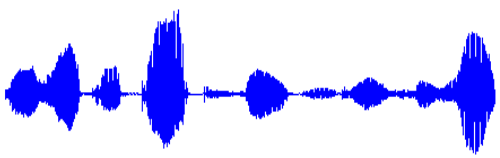


Training data is a lot of images

Learning Map



Structured Learning - Beyond Classification



f

“大家好，歡迎大家來修機器學習”

Speech Recognition

“機器學習”

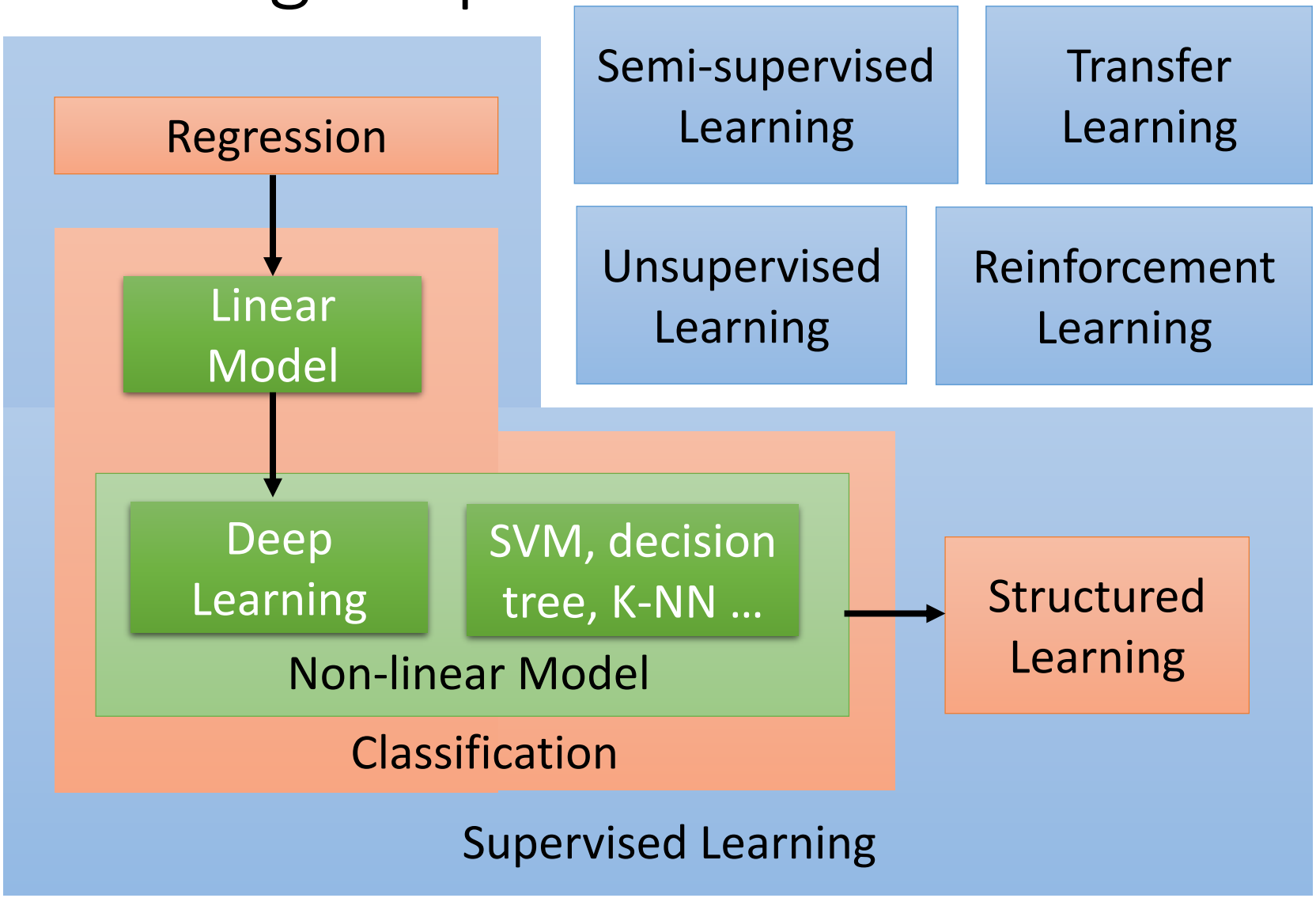
f

“Machine Learning”

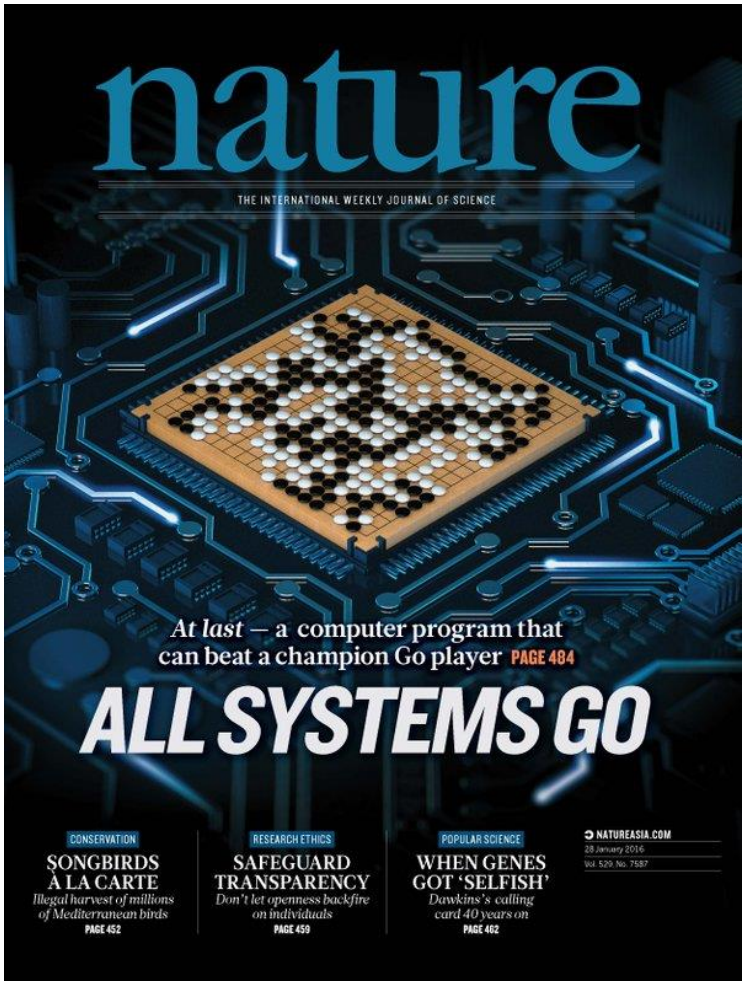
Machine Translation

人臉辨識

Learning Map



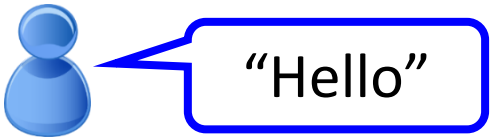
Reinforcement Learning



Supervised v.s. Reinforcement

- Supervised

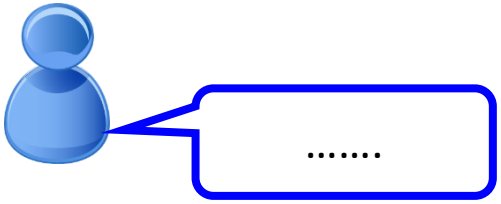
Learning from teacher

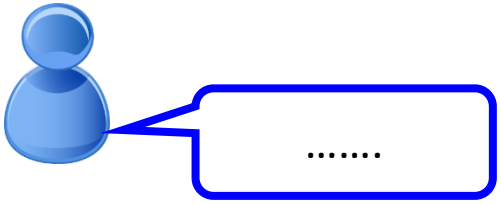


Say "Hi"

Say "Good bye"

- Reinforcement

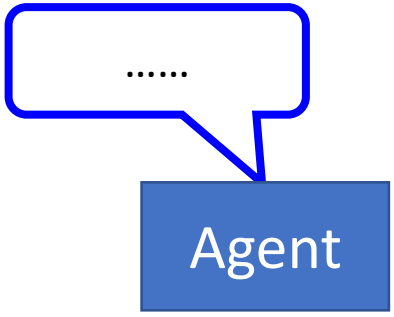




.....

Bad

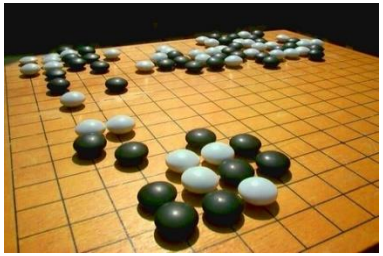
Learning from critics



Supervised v.s. Reinforcement

- Supervised:

Next move:
"5-5"



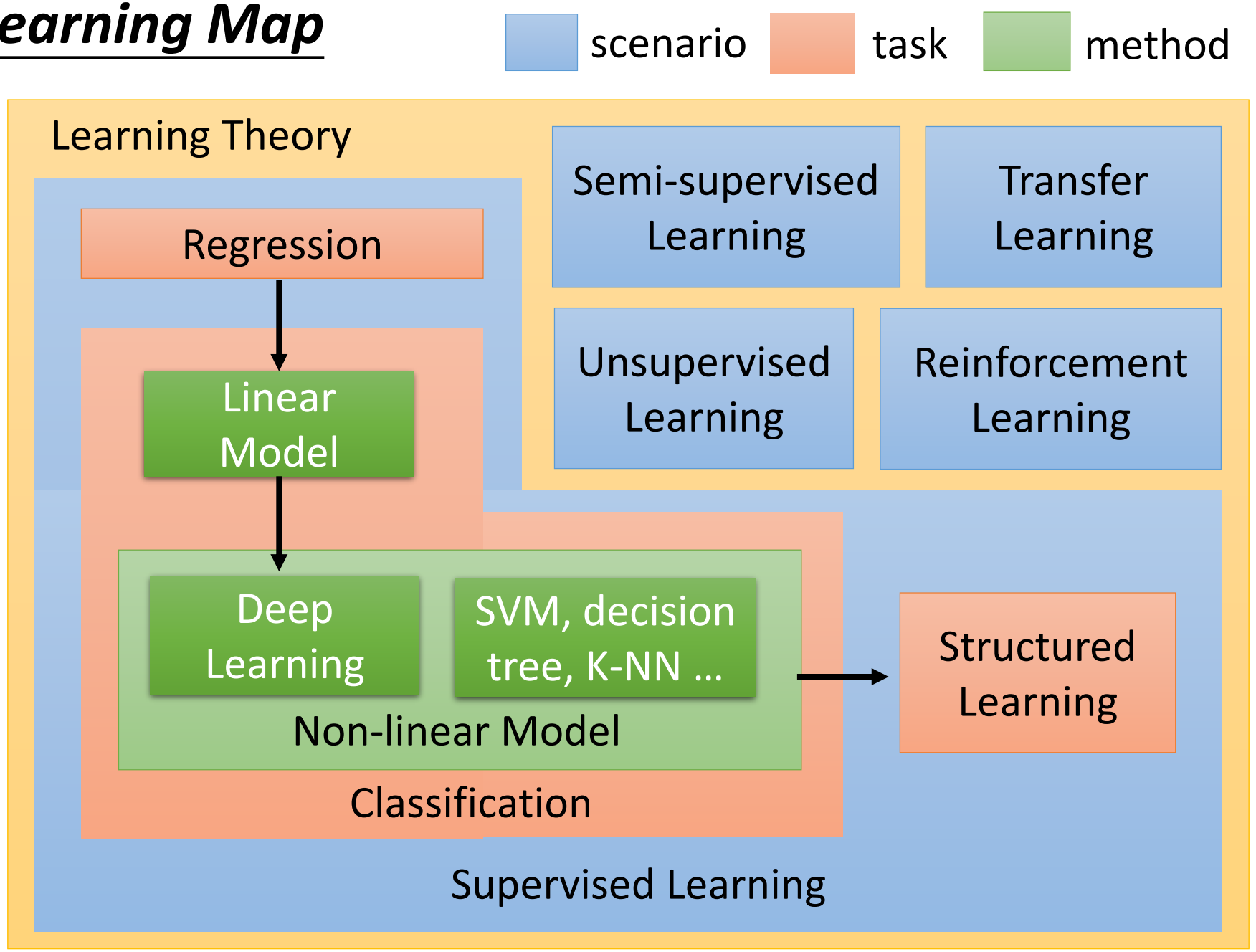
Next move:
"3-3"

- Reinforcement Learning

First move → …… many moves …… → Win!

Alpha Go is supervised learning + reinforcement learning.

Learning Map



Why we need to learn Machine Learning?

AI 即將取代部分的工作? 新工作：AI 訓練師

AI 訓練師

機器不是自己會學嗎？
為什麼需要 AI 訓練師

戰鬥是寶可夢在打，
為什麼需要寶可夢訓練師？

神奇寶貝第5集 尼比市的決鬥

https://www.youtube.com/watch?v=uUOZZb8eJ_k

AI 訓練師

寶可夢訓練師

- 寶可夢訓練師要挑選適合的寶可夢來戰鬥
  - 寶可夢有不同的屬性

AI 訓練師

- AI訓練師要挑選合適的 model, loss function
  - 不同 model, loss function 適合解決不同的問題

神奇寶貝第106集 噴火龍·就決定是你了

https://www.youtube.com/watch?v=4G_aoKiCDc4

AI 訓練師

寶可夢訓練師

- 寶可夢訓練師要挑選適合的寶可夢來戰鬥
  - 寶可夢有不同的屬性
- 召喚出來的寶可夢不一定聽話
  - E.g. 小智的噴火龍
  - 需要有經驗的寶可夢訓練師

AI 訓練師

- AI訓練師要挑選合適的 model, loss function
  - 不同 model, loss function 適合解決不同的問題
- 不一定能找出 best function
  - E.g. Deep Learning
  - 需要有經驗的 AI 訓練師

大家還記得寶可夢的開場嗎？

https://www.youtube.com/watch?v=NyCNkq4ByzY

http://www.gvm.com.tw/webonly_content_10787.html

AI 訓練師

- 厲害的 AI ， AI 訓練師功不可沒
- 讓我們一起朝 AI 訓練師之路邁進